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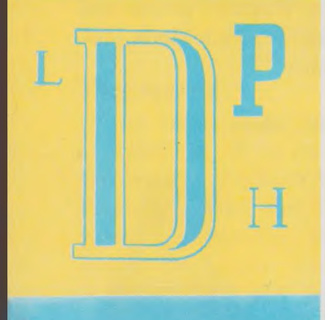

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DRESS

Byzantine

Mediaeval

Mediaeval

PREHISTORIC man covered himself with leaves or skins, as a protection against the elements. But as man grew more civilised dress developed a new significance, not only for the wearer, but also for later historians. For the type of cloth, the cut, and the colour scheme of a man's clothes could indicate his social position and the country from which he came, as well as the times in which he lived. Poor people and country folk wore a simplified version of the fashions at court.

We can learn from the paintings, mosaics, sculptures, and books of other ages how styles in dress have changed under the influence of historical events. Invasion by a foreigner, the arrival of a new queen, the whim of a king, or a nobleman's attempt to disguise some deformity, have all led to changes in fashion.

In times of war both men and women wore clothes with a military cut, decorated with brass buttons; in times of peace and plenty, the flowing styles in rich, soft fabrics often had a pastoral simplicity. The development of a rich empire showed itself in an exotic confusion of styles and in jewelled decoration; but after some world-shattering event such as a revolution or the execution of a king, colours and styles were subdued until the return of peace.

But these general characteristics do not really tell the whole story. Let us see how fashions developed through the ages.

The classical styles

The Ancient Greeks and Romans wore very similar styles; both men and women folded or draped lengths of material around themselves to form long or short tunics and cloaks, which were held together by belts or shoulder-brooches.

Classical styles were copied with local variations throughout Europe until about the 13th century. The Byzantines developed the *dalmatica*, a tunic with long sleeves. Men wore this knee- or ankle-length, under a cloak. Women wore it long with a large shawl, sometimes decorated with jewels. From Asia came the *caftan*, a cloak with wide sleeves, which was worn over the dalmatica; soon it was the fashion to wear two tunics, one with long, narrow sleeves under another with wide, cuffed sleeves.

Until the 13th century European men wore long-sleeved tunics under a cloak or sleeveless *surcoat*. Women's arms were completely covered, sometimes almost to the fingertips (a fashion lasting until the 17th century); their long trailing gowns had flared skirts and their hair was tied under a scarf or *kerchief*.

The surcoat, worn by both men and women, developed a new look in the 13th century. It became multi-coloured, with huge, deep armholes nicknamed the 'windows of hell'. The armhole edges and the hem were cut into strange, jagged patterns, called *dagging*, and sometimes trimmed with fur. The sleeves and shoulders of the tunic underneath were now puffed and padded.

The growth of English fashion

During the reign of Edward III (1327–1377) England began to have an identity of its own as a unified country; clothes soon became an expression of personal taste that was recognisably English. Shapes were altered with remarkable frequency. Over the next few centuries men and women were to be transformed by horsehair padding, wire hoops, and wickerwork frames into squares, diamonds, or triangles.

The *houppelande* appeared in about 1415 and remained in fashion for some 60 years – a long time by present-day standards. It was a voluminous gown worn by both sexes. The sleeves were vast, their dagged edges often sweeping the floor so that the wearer, to avoid tripping himself up, had to tie knots in the ends, or loop them over his arms. Women wore houppelandes with low neck-lines, above which towered tall, conical head-dresses, or *hennins*, with floating veils. Men often wore flat hats with trailing ends, tight, high collars, and heavily padded shoulders. Young men wore coloured tights (*stocks*), and a slit-sided version of the houppelande so short it only just covered the waist; older men favoured a long gown with a belt slung at hip level.

Continental influences

Under Italian influence, the short houppelande became the *doublet*, a short jacket belted at the waist and worn over a shirt. In the early 16th century a square silhouette was achieved by heavy padding at the shoulders and hips. Women's gowns and head-dresses also had a square look, introduced from Germany.

Italian, about 1510

Previous page: A tailor's shop in the 17th century.

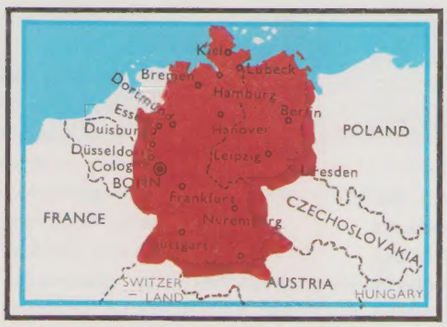
CITIES OF GERMANY

GERMANY occupies a key political position between Western Europe and the Communist bloc. The boundary between the two actually divides Germany into an eastern (Communist) zone and a western one, declared a Federal Republic on 5th May 1955.

Germany is also remarkable because five of Europe's greatest rivers flow across her: the Elbe, Weser, Oder, Danube, and Rhine. Ocean-going ships can penetrate far inland up these rivers, bringing raw materials and taking away Germany's coal, steel, and other exports.

On these rivers stand nine great city-ports, each with over half a million inhabitants.

The Brandenburg Gate was built in 1793, copied from the Propylaea in Athens. It stands at the entrance to East Berlin



Map showing the principal cities of Germany

Ten states

In the mid-19th century Germany was a collection of 39 independent states, the largest of which were Austria and Prussia. Today the Federal Republic (western Germany) is made up of 10 states, or *Länder*. Each state has its own capital and government, and sends representatives to a Federal Council, or *Bundesrat*; the country as a whole is governed by a Federal parliament, or *Bundestag*, under a Chancellor and President.

A divided city

Berlin, former capital of Prussia and, until 1945, of the German Empire, was once the second largest city in Europe and a commercial and cultural centre. Today the city lies some 70 miles inside Communist territory; the eastern and western sectors are divided by a high wall, erected by the Communists in 1961.

The eastern sector (population 613,000 and decreasing) is the capital of East Germany. The western sector (population 2,202,000) is administered jointly by the Americans, British, and French.

About 30 per cent of the city's wide avenues and elegant buildings was destroyed during the Second World War. Much has now been rebuilt and the industries, universities, and theatres are flourishing.

A free port

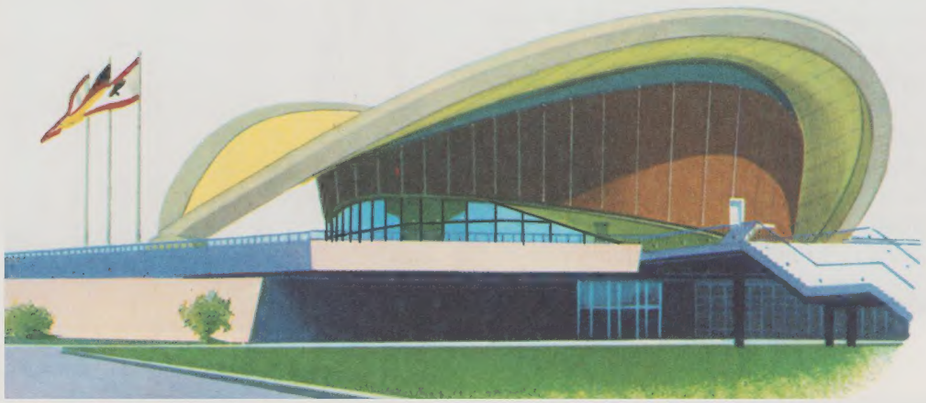
Hamburg (population 1,837,000) is Germany's principal port and second largest city, and is the capital of its own state. It became a 'free' (self-governing) city in 1510. A disastrous fire destroyed the old city centre in 1842 so that most of Hamburg is comparatively modern.

Hamburg stands at the head of the river Elbe's estuary, 55 miles from the North Sea. There are

Hamburg has vast dockyards on the banks of the Elbe

27 square miles of dockyards, handling both river and overseas traffic. Shipbuilding, fishing, and the processing of raw material are the main industries. Two of the many canals in the Hamburg area connect with the ports of Kiel and Lübeck.

Bonn (population 147,000) is now the capital of the Federal Republic. The city, founded by the Romans in about 10 B.C., overlooks the river Rhine. It has a beautiful basilica and a famous university. The house where Beethoven was born is now a museum.



The Congress Hall, in the Tiergarten *district of Berlin*

Munich: the royal palace in Odeonsplatz. *Left, the baroque* Theatiner *church; centre, a statue of Ludwig I, King of Bavaria, who rebuilt much of the city in the 19th century*

Centre of learning

Munich (German, *München*; population 1,101,000) is the gay capital of Bavaria, the southernmost and largest German state. It is famous for carved wooden toys and cuckoo-clocks, and for its many festivals, such as the Oktoberfest, when the local beer is drunk in large quantities.

Munich was founded in the 12th century as a convenient trading post at the foot of the Bavarian Alps, on the river Isar, a tributary of the Danube. Its commercial importance grew over the centuries and it also became a centre of learning and the arts; the university was founded in 1472. During the 19th century, the art-loving kings of Bavaria built up magnificent collections here; they also rebuilt much of the city, giving it a new charm and elegance. Munich saw the rise of Hitler and his National Socialist party, and unfortunately most of the beautiful old buildings were damaged or destroyed during the Second World War.

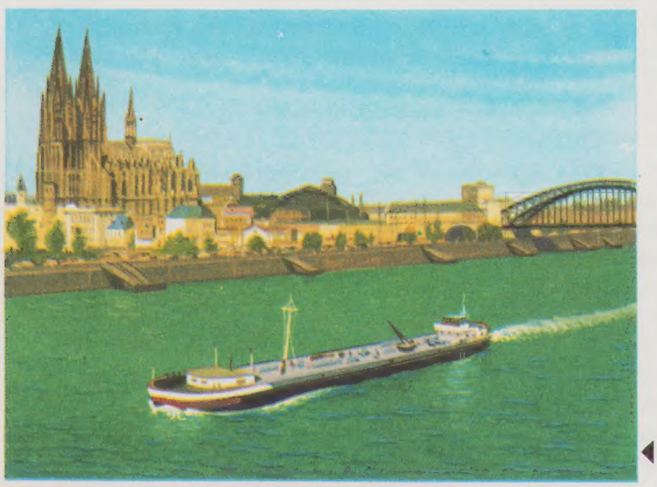
Essen (population 729,000) lies at the centre of the Ruhr, the great iron- and coal-mining region of north-western Germany. Essen itself has the main steel manufacturing works, as well as chemical, textile, glass, furniture, and cement factories. Essen was only a small town from the 9th to the 19th centuries. Then the Krupp family established the first steel mill here in 1810. Later they also constructed 'villages' for the workers, which have served as models to other industrial countries. Canals now connect the city with other mining areas and with the Rhine.

Düsseldorf (population 698,000) has been the capital of the state of North Rhine-Westphalia since the Second World War. The city has a deep-water harbour on the river Rhine, and exports the products of the Ruhr industries. During the Second World War Düsseldorf was the centre of the armaments industry, and was therefore subjected to heavy bombing; about 65 per cent was destroyed.

Today, Düsseldorf is as famous for its many parks as for its industries and dockyards. It has a well-known academy of art, founded in 1819, and also a medical school.

Queen of the Rhine

Cologne (population 801,000) has been the hub of European trade and communications since Napoleonic times. The five harbours handle ocean-going passenger and merchant ships, receiving raw materials and exporting the products of its metal works. The pharmaceutical industries have been famous for 'eau de Cologne' since 1700. Cologne (German, *Köln*) was an outpost of the Roman Empire founded in A D 50, and its powerful archbishops were princes of the Holy Roman Empire. The first railway bridge across the Rhine was built here in the 1850s.



◀ *A Rhine barge passes Cologne's 13th-century cathedral*

Dortmund (population 641,000) is the second largest city of the Ruhr (see page 132), and was in existence as early as A D 879. Here begins the Dortmund-Ems Canal, which gives access to the North Sea; Dortmund has large dockyards which export the refined petroleum, steel, coke, coal, and beer produced in this region.

In the 13th century Dortmund was a member (with other northern ports) of the Hanseatic League, a group of Baltic states which joined together to trade with the rest of Europe. Little of the old section of Dortmund survived the Second World War, but the industries have all been re-established.

FRANKFURT AM MAIN

Frankfurt (German, *Frankfurt am Main*; population 675,000), in the state of Hesse, is the headquarters of Germany's chemical and publishing industries; the latter was transferred here from Leipzig in 1945. It has a famous zoo and international airport.

The city was founded by the Romans and since the Middle Ages a Trade Fair has been held there twice a year. Charlemagne had a palace at Frankfurt, and later Holy Roman Emperors were crowned in the Gothic cathedral of St Bartholomew.

◀ The Gothic cathedral, Frankfurt

Stuttgart

Stuttgart (population 637,000) is the capital of the state of Baden-Württemberg. It is on the river Neckar, at the junction of all the principal railway routes and also has an airport.

Stuttgart is famous for paper-making, publishing, optical and precision instruments such as cameras, and the world's oldest car factory.

Round the city lie several tourist and health resorts and at nearby Heidelberg is the famous University.

Ludwigsburg castle, near Stuttgart, built by the Dukes of Württemberg in the 18th century

Leipzig

Leipzig, with a population of 590,000, is the second largest city of East Germany. Its central position at the confluence of three rivers made it an important trade centre in the past.

Since the 1480s, Leipzig has been famous for printing and publishing; young writers, including Goethe and Schiller, gathered here in the 18th century, and Bach, Schumann, Wagner, and other musicians worked here.

The annual Trade Fairs, famous since the Middle Ages, have been revived since the war, with international success, but the publishing industry is now centred at Frankfurt.

Lübeck: the 15th-century city gate, all that remains of the mediaeval fortifications

Lübeck

The active Baltic port of Lübeck (population 232,000) lies near the East German border in the state of Schleswig-Holstein. Once the head of the Hanseatic League, it still has large dock- and shipbuilding yards, as well as a naval academy and famous music school.

The inner city is still mediaeval in character; the old council hall or *Rathaus* is one of Germany's finest.

HANOVER

Hanover (population 575,000) has been the capital of Lower Saxony since 1945. It is on the river Leine and the Weser-Elbe canal, both of which carry away the city's exports: cars, machinery, chemicals, chocolate, cigarettes, and beer.

Hanover, once a member of the Hanseatic League, was formerly in the state of Brunswick and its ruler became George I of England. The Kings of England ruled Hanover until the reign of Queen Victoria. The royal palace and castle were both destroyed during the Second World War. In the 1890s Hanover became part of Prussia.

An international Trade Fair is held in Hanover each year, and also a flying show.

Duisburg (population 503,000) is Europe's largest inland port, and has a deep-water harbour. It is on the Rhine and its shipping handles most of the products and raw materials of the Ruhr.

Dresden (population 494,000) is an old city, dating from the 13th century, on the river Elbe in East Germany. Dresden has always been a centre of the arts, visited by Germany's most famous musicians, writers, and artists. The fine china known as 'Dresden' is in fact made at Meissen, 14 miles away.

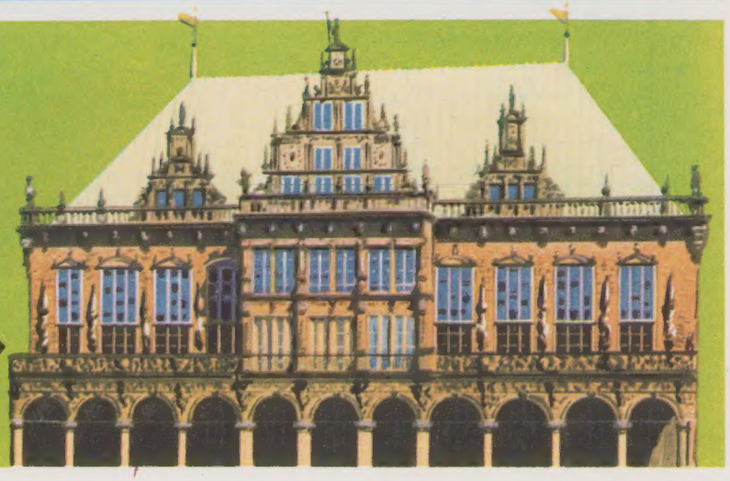
Nuremberg (German, *Nürnberg*; population 458,000) in Bavaria is famous for toys, gingerbread, and machinery. It was the home of artists such as Dürer, whose house is now a museum, and had a mediaeval school of 'meistersingers'. The first pocket watches, known as 'Nuremberg eggs', were made here. Most of the mediaeval city, including the Hohenzollern fortress, was damaged during the last war.

Kiel (population 271,000), once a great naval base, is now Germany's principal fishing port and capital of Schleswig-Holstein. It stands at the mouth of the Kiel Canal, started in 1887, which joins the Baltic to the North Sea near Hamburg.

BREMEN: THE OLDEST SEABOARD CITY

At the mouth of the Weser stand Bremen and Bremerhaven (population together 704,000). Bremen has been a great port since the 9th century and is still known as *Freie Hansestadt Bremen* – a free city and member of the Hanseatic League. Much of mediaeval Bremen still stands; the great statue of Roland, erected in 1404, faces the twin-spired Gothic cathedral of St Petri.

In 1827 Bremerhaven was founded 35 miles away to handle the transatlantic liners; it is now the principal starting point for trade with, and emigration to, America. Bremen produces lager, cigarettes, machines and ships of all sizes, cars, and textiles.



The *Rathaus*, or Town Hall, of Bremen, originally Gothic but refaced in Renaissance style

THE COURT OF THE GREAT KHAN

ALEXANDER, Caesar, Napoleon – these are the men that spring to mind as the great conquerors of history. But there was one conqueror who among them is as a giant among pygmies. He was called Genghis Khan, and 700 years ago he conquered half the known world. At the head of his great hordes he swept across Asia, ultimately bringing the whole area from the China Sea to the Black Sea under his dominion. He must have travelled farther on his campaigns and caused more ruthless destruction in his conquests than any other warlord. Yet Genghis Khan was not only a brilliant soldier; he was a wise and intelligent ruler and the great empire he built was strong enough to survive his death and indeed his powerful grandson Kublai Khan smashed his way into the Middle East and took Baghdad, the cultural centre of Asia Minor.

Emperor of All Men

Genghis Khan was given many names during his lifetime; he was known as the Mighty Manslayer, the Scourge of God, and Master of Thrones and Crowns, and he styled himself Emperor of All Men. But his real name was simply Temuchin. He was born in 1162, the son of a leader of one of the numerous small Mongolian tribes of the Gobi Desert in central Asia. How then, from the anonymous obscurity of the great Gobi Desert, did the son of an ordinary tribal chief come to march to the ends of the earth?

When Temuchin was 14 his father died, and the rule of the tribe passed to him. At first his people were rebellious and disrespectful to so young a leader; but Temuchin came to inspire devotion in his own tribe and welded them together in a closely knit fighting unit. They subdued other Mongolian tribes and as Temuchin's fame grew more and more flocked to his banner. In 1206 for the first time all the Mongolians united under one commander, unanimously voting Temuchin their leader, and giving him the title of Genghis (Perfect Warrior) Khan. Thus Genghis Khan became the father of Mongolia. He now set his sights farther afield, to fabulously wealthy Cathay (China).

The Mongolian tribes had been battering feebly at the Great Wall of China (see page 2158) for years, but in 1211 Genghis used his newly won authority to organise his great hordes into a terrifying and disciplined army, and broke through the Chinese defences. Murdering and pillaging, he advanced relentlessly southwards, his barbarians subduing and plundering province after province of the ancient and highly civilised empire. In 1215 he retired once more to his desert, leaving one of his most trusted commanders behind to maintain his authority.

YOU SHOULD NOW KNOW

1. *What was Genghis Khan's real name?*
2. *What desert was his home?*
3. *Where was his capital?*
4. *How far did his empire extend?*
5. *What was his body of laws called?*

Genghis Khan's camp outside the walls of his capital Karakorum in the Gobi Desert. On the left the Khan stands surrounded by his most trusted warriors

Until now Genghis Khan had confined his ambitions to eastern Asia. But back in the desert tales reached him of lands to the west containing cities which outshone even the gorgeous palaces and temples he had seen in Cathay. In 1219 he set out to cross the Hindu Kush. This daunting range of mountains had from time immemorial cut the desert people off from the civilisations of western Asia. On the other side of it lay the great Muslim empire of Khwarizm, which reached from the Indus to Baghdad and from Lake Aral to the Persian Gulf. In a fantastic march Genghis led his warriors, now reinforced with contingents from Cathay, across the desert and over the mountains; and his appearance on the borders of Khwarizm took it completely by surprise. He thoroughly outwitted the Muslim ruler Mohammed Shah; one after another the great Muslim centres – Otrar, Khokand, Bokhara, Samarkand, Merv, Nishapur, Balkh, and Herat – fell to him. Mohammed Shah died and his heir Jalal-ud-Din was chased into India. In 1221 Genghis returned victorious to Mongolia. Meanwhile two of his best commanders, Chebe-Noyen and Subutai Bahadur, continued a triumphant progress from the southern shore of the Caspian into the Crimea; they entered Bulgaria and even reached the Adriatic.

A DESERT COURT

Genghis Khan, whose 13th-century empire extended from China to Persia

Genghis Khan could have had as his capital any of the beautiful towns of Persia or Cathay, but he chose instead Karakorum, an isolated city among the dry, desolate plateaux of Mongolia. Genghis had been born near here on the shores of Lake Baikal, it was here that he had learned to fight, and it was here that he returned in 1227 to die. Maybe he established his court in a place like this because he wished to keep alive the sense of adventure and hardship which desert life had instilled in his nomadic followers.

Genghis Khan could neither read nor write, but contact with the Chinese and Persian cultures taught him to appreciate the importance of these accomplishments. He realised that he must have the help of educated men to govern his huge empire. So he invited to his court a number of foreign men of learning; chief amongst these was Ye Liu Chutsai, a famous sage of Cathay who was the Khan's constant companion and adviser. Genghis conscripted huge numbers of craftsmen and artists from the various countries that he conquered, and brought them back to Karakorum – carpenters, musicians, and men of medicine. To Karakorum also came the fantastic spoils of battle which he always allowed his nomads to seize as soon as a battle was over; and within the city were built all manner of religious buildings, for Genghis allowed all his varied subjects to worship according to their native religions.

Round about the walls of the city the plain was dotted with thousands of *yurts* (tents). This was where his great army lived between campaigns; at such times Genghis would organise tremendous hunts, to keep his men in training. From Karakorum were issued the *Yassa*, his great body of laws which dealt with every aspect of his subjects' lives and by which he managed most effectively to control his far-flung empire. Centred on Karakorum also was his fantastic postal system. A chain of relay stations extended from one end of the empire to the other and the best horsemen of the land ensured that the Khan was kept in touch with life in every corner of the empire.

A L G A E

IF you were to ask a botanist to give you a definition of the group of plants known as algae, he would probably say that he could not do so, because there is no such group of plants. The fact is that the plants known as 'algae' to the earlier botanists have been classified out of existence. That is to say, they have been split up into a number of separate major groups or Divisions of the plant kingdom, whose relationship to each other is uncertain or entirely unknown. This is made clear on the opposite page, where each of these Divisions is separately described and illustrated. Nevertheless 'algae' is still used as a convenient term to include all these Divisions of primitive plants, and it is in this sense that we use it here. 'Algae' is the plural of the word; the singular is 'alga'.

Algae are by far the most ancient of plants, in fact they are the earliest form of life that is known. Fossils that appear to be algae have been found in rocks that were deposited about 2,700 million years ago; the earliest well-preserved fossils of animals are about 600 million years old.

Algae are also extremely diverse in size, appearance, and structure. Over 20,000 different species are known. Most of them are minute and high-powered microscopes are needed in the study of them; many of them consist of single cells or of long threads or filaments of cells placed end to end.

The seaweed *Macrocystis pyrifera* is longer than the tallest tree; here it is compared with a Eucalyptus and a cathedral

Algae are of enormous importance in the economy of nature. In the sea the minute forms that float in the water, the *diatoms*, carry out photosynthesis, making food out of inorganic materials and releasing oxygen just as land plants do (see page 332). Just as all life on land depends ultimately on green plants, so does all life in the sea, from whales downwards, depend on the diatoms and to a lesser extent on other marine algae such as seaweeds.

The algae have certain features in common. They are all primitive with very little differentiation of tissues for various purposes, such as we find in the higher plants; thus they have no true roots, stems, or leaves. Most of them live either in fresh water or the sea; those that inhabit the land require moist conditions for their growth and reproduction. All of them (except for a few parasitic kinds) possess chlorophyll, but its green colour is often concealed by other pigments.

Reproduction. Algae reproduce themselves in a great variety of ways, including simple division of the body (vegetative reproduction), production of spores, and processes involving fertilisation. In these processes pairs of cells called *gametes* unite and fuse together. Some of the gametes can swim actively in the water.

Form and appearance. The algae include both the smallest plants and the longest (if not actually the largest); the great seaweeds of the Antarctic (*Macrocystis*) may approach 200 yards in length. Of the microscopic forms, the diatoms are remarkable in possessing silicious or flinty 'skeletons' which, although they are minute, are intricately sculptured and perforated. The Euglenophyta are of great interest on account of their close resemblance to the flagellates, which are primitive animals belonging to the Phylum Protozoa; a *Euglena*, with its green chlorophyll taken away and provided with a mouth with which to feed, would be indistinguishable from a flagellate. These creatures really represent the point where the animals and plants branched away from each other in the course of evolution.

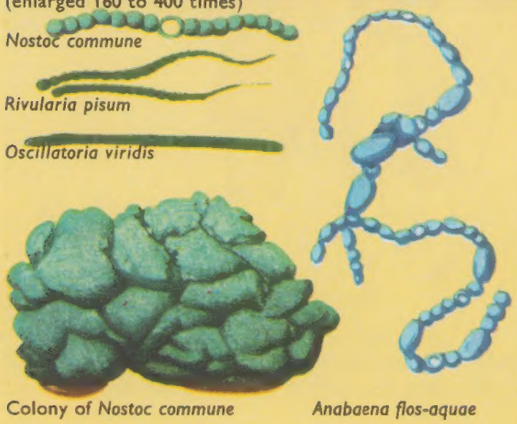
Where they are found. Algae are most abundant in water, both in fresh water and in the sea. Most large forms are marine and these make up the various types of plant that we call seaweed. The most common fresh-water algae that can easily be seen are the filamentous or thread-like green algae, which often form slimy green masses floating on ponds. On land they grow in damp places; the green powdery substance that often covers the bark of trees is an alga called *Micrococcus*.

BLUE-GREEN ALGAE AND NITROGEN FIXATION

Nitrogen is required by all forms of life because it is one of the components of protein. Animals get their nitrogen from plants; plants get it, in the form of nitrates, from the soil. The atmosphere consists largely of nitrogen, but ordinary plants and animals cannot combine this gaseous nitrogen with other elements to make chemical compounds; that is, they cannot make use of it. This can only be done by some bacteria and algae, especially the blue-green algae (Cyanophyta). They can 'fix' nitrogen from the air, combining it with other elements to build up their own bodies. When they die the nitrogen compounds they have made serve to enrich the soil. The fertility of tropical ricefields is largely maintained by blue-green algae.

THE PLANT DIVISIONS WHICH MAKE UP THE 'ALGAE'

(enlarged 160 to 400 times)



Colony of *Nostoc commune* — *Anabaena flos-aquae*

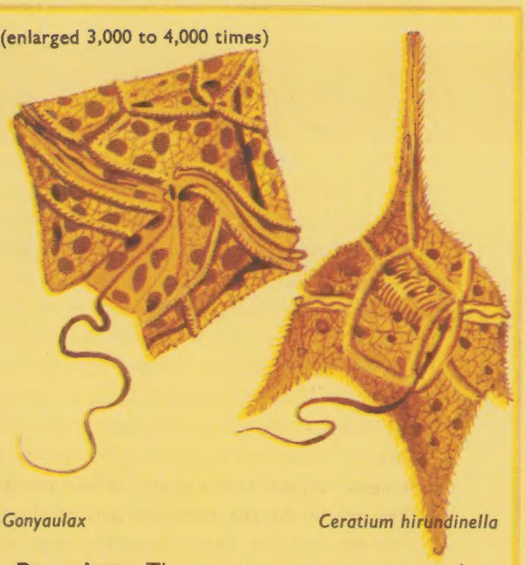
Cyanophyta or blue-green algae. Microscopic, single-celled organisms found in the sea, in fresh waters, and in damp places on land.

(enlarged 2,000 times)

Two varieties of *Euglena viridis*

Euglenophyta or flagellate algae. Microscopic forms which have flagella (tails) with which they swim in the water.

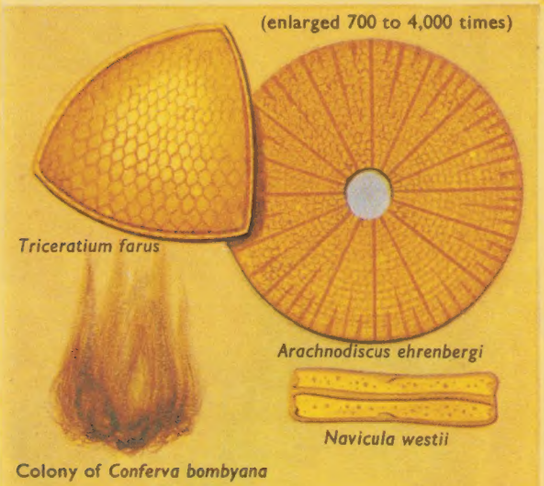
(enlarged 3,000 to 4,000 times)



Gonyaulax — *Ceratium hirundinella*

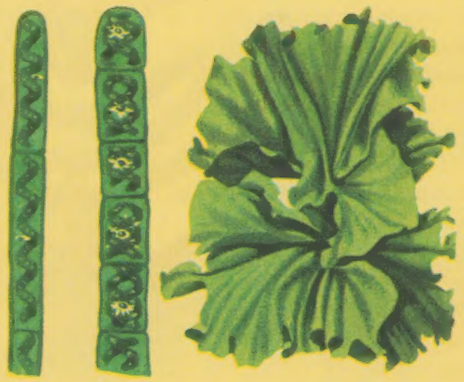
Pyrophyta. These are very minute, curiously-shaped, brown or yellow algae which swim by means of flagella. Most of them are marine.

(enlarged 700 to 4,000 times)



Colony of *Conferva bombyana*

Chrysophyta or yellow algae. These include some filamentous yellow algae, but the best known of them are the diatoms, which inhabit the sea and fresh waters in huge numbers.

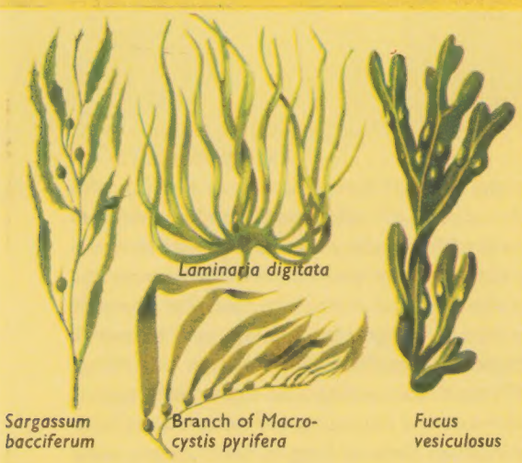


Two species of *Spirogyra* — *Ulva lactuca*

Chlorophyta or green algae. These are the 'highest' of the algae and are probably ancestral to the higher plants. The sea lettuce (*Ulva*) and the thread-like *Spirogyra* are well known. *Spirogyra* is sometimes found in stagnant ponds; here it is highly magnified.

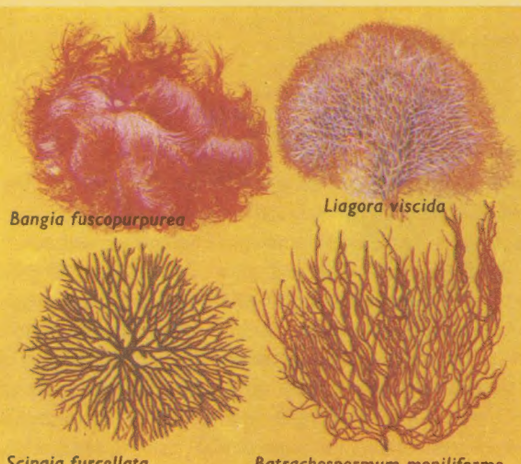
Nitella — Branch of *Chara foetida*

Charophyta or stoneworts. These are fairly large, branched algae of fresh and brackish waters, often brittle through impregnation with lime. Both species illustrated live in ponds.



Sargassum bacciferum — Branch of *Macrocystis pyrifera* — *Fucus vesiculosus*

Phaeophyta or brown algae. Most of the common shore seaweeds are included here. *Fucus* is the familiar bladder-wrack of European shores and *Sargassum* is the floating seaweed of the Sargasso Sea. Almost all brown algae are marine.



Scinaia furcellata — *Batrachospermum moniliforme*

Rhodophyta or red algae. These are also seaweeds, but many of them grow at greater depths than the brown algae; none of them reach a very large size. Most of the edible seaweeds belong to this group.

USES OF ALGAE

Several kinds of red algae are used by man as food. The most important is *Porphyra*, which is cultivated in Japan in sheltered bays where the water is of suitable depth – 15 to 25 feet. Another red alga, *Rhodymenia palmata*, is eaten in northern Europe and is known as dulse in Scotland.

On the coast of California large seaweeds (brown algae) called kelp are collected, and form the basis of manufacture of alginates, which are used for various purposes in food manufacture and in industry. Agar-agar is a jelly like substance made from a red alga called *Gelidium*. Its most important use is for making jelly on which to grow cultures of bacteria in medical and biological research.

Ordinary seaweed, such as *Fucus*, can be gathered on the shore and used as fertiliser on cultivated land near the sea.

EUROPE IN THE 17th CENTURY

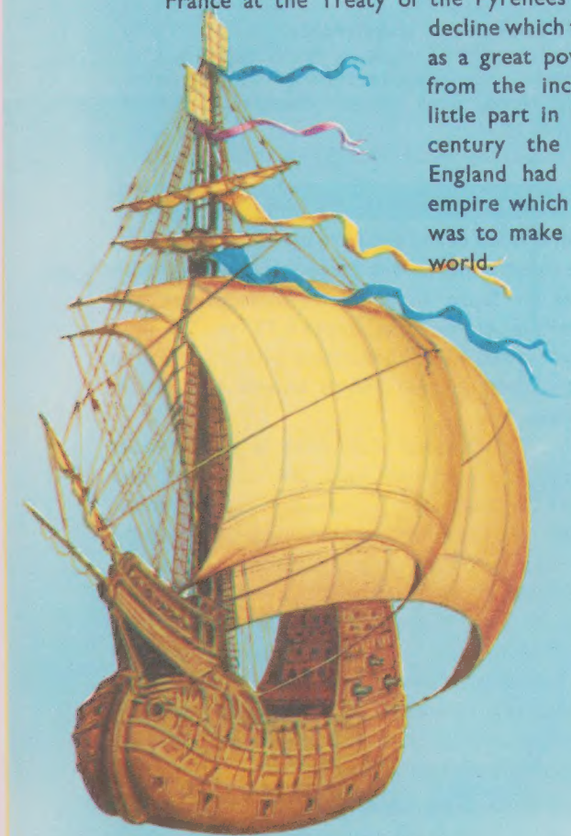
THE 16th-century Renaissance greatly accelerated the process by which Europe became divided into vigorous, independently-minded national states. The Reformation and the Counter-Reformation split them sharply into great camps – those who were Catholic and those who were Protestant. The 17th century – a century of wars – saw the working out of these great movements. The Protestant princes of Germany aided by Protestant Sweden fought against Catholic Austria aided by Catholic Spain. As well as reasons of faith the nations fought for reasons of state. Catholic France fought against the Austro-Spanish alliance while at intervals throughout the century Protestant English fought Protestant Dutch for commercial supremacy.

The result was that, broadly speaking, the outlines of modern European history were drawn. Those nations who were destined to be great and play important parts in the modern world rose. Those who could not withstand the competitive national rivalries of the 17th century declined, and declined further in succeeding centuries. Thus France, who had dominated most of the century, established herself as a great power. Sweden, who had her brief moment of glory, was at the end of the century at grips with Russia, who herself was shortly to take over from Sweden as the chief power in the north. In this article we will look at some of the nations which were rising.

The focal point of the 17th century was the Thirty Years War, 1618–1648. And the Treaty of Westphalia of 1648, which brought it to an end, was a 'watershed'. As France and Sweden gained at Westphalia, so the House of Austria lost, and lost control of the Germanic states of the Holy Roman Empire. Austria continued to be a great power, but no longer the only great power in Germany – for Brandenburg was slowly gathering that strength which was to make her, under the name of Prussia, the rival and ultimate conqueror of Austria, and under the name Germany the near-conqueror of Europe. Spain, who had dominated the 16th century almost as France dominated the 17th, lost heavily to France at the Treaty of the Pyrenees (1659) and went into a rapid decline which took from her for ever her status as a great power. Meanwhile England, apart from the inconclusive Dutch wars, played little part in Europe. Yet at the end of the century the Dutch were declining; and England had begun to found that far-flung empire which in the 18th and 19th centuries was to make her the greatest nation in the world.

Two noblemen of the 17th century

Henry IV, King of France



A 17th-century warship

ENGLAND

The 17th century was not a happy one for England. Twice she deposed her monarchs. In 1649 Charles I was executed and in 1688 the Glorious Revolution replaced James II with the Dutch king William and his wife Mary. Oddly enough, England's great enemy in the 17th century was the United Provinces (Holland), because England and Holland were fighting for maritime and commercial supremacy; and in particular their colonial interests clashed both in America and in the Far East. Yet towards the close of the century it became apparent that we had a far greater enemy, and so public hostility turned against Catholic France. Charles II accepted large subsidies from the 'Sun King' which enabled him partly to ignore Parliament's anti-French clamouring and fight wars against the Dutch in 1665 and 1673. In addition he maintained a benevolent neutrality in France's wars with Holland even when he himself was not engaged. When William became king in 1688 people were only too pleased to join him in his struggle against France. So the Grand Alliance was formed in 1689 and from then until the close of the Spanish War of Succession in 1714 England was almost constantly at war with France. In the 17th century the foundations of English colonial power were laid. The East India Company, founded in 1600, established trading stations in many parts of India, while the Virginia Company (1606) and the Pilgrim Fathers (1620) began that expansion of the New World which developed into the 13 colonies which were the nucleus of the United States of America.

FRANCE

France was easily the most powerful nation in the 17th century. In Europe she was without a serious rival, while overseas she was beginning to found her New World Empire which was to be the cause of so much strife with England in the next century. France's strength was largely due to her first Bourbon king, Henry IV, who united the country under his strong leadership after a generation of civil war (1562–1589). And it was even more due to the great Cardinals Richelieu and Mazarin (see pages 2384 and 2266), who strengthened the power of the Crown, destroyed the independence of the great nobles, and by their astute diplomacy helped France to victory in the Thirty Years War. At the Treaty of Westphalia France gained Alsace and was confirmed in the possession of several bishoprics such as Metz and Verdun, while her ally Sweden gained Western Pomerania. By the Treaty of the Pyrenees with Spain (1659) France gained Rousillon and much of Flanders.

Louis XIV began his personal rule in 1661 with no enemies either at home or abroad; and he represented absolute monarchy at its zenith. He was the 'Sun King' around whom everything else revolved – nobles, ministers, generals, artists, musicians, writers. Not only France, but all Europe looked to Louis's magnificent court at the new palace of Versailles. French manners, customs, and fashions were adopted everywhere. Meanwhile such able ministers as Sully and Colbert were making France economically great while abroad superb generals like Turenne and Condé won famous victories. In the War of Devolution (1667–1668) against the Spaniards Louis gained territories in the Low Countries which made the neighbouring Dutch afraid that Louis had ambitions in Holland. And he had. In 1672 he launched a war against the Dutch which resulted in the triumphant Treaty of Nijmegen and several additions to French territory. Turning his attention to Germany, Louis annexed Strasbourg (1681) and Luxemburg (1684). His insatiable ambitions antagonised Europe, and the Grand Alliance including the Holy Roman Emperor, England, Holland, and Spain was formed against him in 1689. At the Treaty of Ryswick (1697) Louis was forced to give back some of his gains, while in 1701 a new war broke out which led to a serious decline in French fortunes in the 18th century.

Frankfurt am Main: the ancient palace where the Holy Roman Emperors were elected

YOU SHOULD NOW KNOW

1. *Which country was the most powerful in the 17th century?*
2. *What was the date of the Treaty of Westphalia?*
3. *In this treaty, who gained Western Pomerania?*
4. *What was Frederick William of Brandenburg known as?*
5. *Who defeated whom at the battle of Narva?*

BRANDENBURG

The 17th century was decisive in the history of Germany. By the Treaty of Westphalia the House of Austria lost much of its authority as leader of the Holy Roman Empire, and the princes of Germany became completely independent. One German state which took advantage of this situation was Brandenburg, which was ruled by the 'Great Elector' Frederick William from 1640 to 1688. In 1647 he obtained Cleve, Mark, and Ravensburg, while at Westphalia he was confirmed in the possession of Eastern Pomerania together with several bishoprics. In 1660 he became the independent ruler of Prussia. The Great Elector's successor was Frederick (1688–1713), who in 1701 adopted the title King in Prussia and so gave Brandenburg its more famous name. Frederick's successor gained Western Pomerania from Sweden, linking up Prussia with Brandenburg; and so the nucleus of the Prussian state was formed.

RUSSIA

As far as Europe was concerned Russia only became important towards the end of the 17th century and even then there was little hint of the large role she was to play in European politics of the next century. Even so, looking back, we can see that the reign of Peter the Great which began in 1685 was a turning point not only in Russian but in European history. Peter modernised Russia, tightened up the administration, and gave her new industries and increased prosperity. In 1696 he captured the fort of Azov from the Turks, giving Russia an outlet on the Black Sea. Then he turned his attention to the Baltic and began a series of wars with Sweden under her youthful king, Charles XII, which was ultimately to result in the cession to Russia of Finland, Livonia, Latvia, and Estonia, and part of Karelia. As the 17th century closed, Peter, after the battle of Narva, looked as if he would forfeit the Baltic to Sweden, but he won a glorious victory at Poltava nine years later. From then on Russia never looked back. During the reign of Peter (see page 2172) and later Catherine the Great (see page 1418) Europe gained a newfound respect for this colossal Asiatic power.

BRITISH ANTARCTIC SURVEY

TOWARDS the end of 1943 a small naval party left Britain secretly for the Antarctic. This operation was known by the code name 'Tabarin'; its intention was to establish two bases, one at Deception Island in the South Shetland Islands and another on the mainland of Antarctica where it projects far northwards as the peninsula of Graham Land.

The reason for this exploit was to counteract the claims for possession of this territory which had recently been made by the Argentine government. This sector of the Antarctic continent and several of the neighbouring island groups had originally been claimed by Britain in 1908 and had been called the *Falkland Islands Dependencies*. Before 1939 this territory had been administered from the Falkland Islands by sending whaling inspectors and magistrates regularly to the islands, which were frequented by the whaling fleets during the short summer period. During wartime this gesture of sovereignty had lapsed, and Argentina took the opportunity to make claims to this part of Antarctica. The government of Chile later added their own claim to the territory. Despite its primary role of counteracting these claims, Operation Tabarin supplied some much needed meteorological information to help weather forecasting in the South Atlantic and Indian Oceans.

It would have been rash in 1943 to forecast that this small naval operation would develop into a major British scientific expedition and that 20 years later its work would still be continuing, but this is in fact what has happened. The expedition ceased to be a naval operation in 1945, and since the signing of the Antarctic Treaty of 1959 (when all national claims to Antarctic territory were put into 'cold storage') the work has had no political significance.

But the scientific importance of the expedition continues. It used to be known as the *Falkland Islands Dependencies Survey* (usually abbreviated to FIDS), but, following the Antarctic Treaty and the renaming of the area *British Antarctic Territory*, it was changed in 1962 to *British Antarctic Survey* (or BAS). Since 1945 it has been administered by the Colonial Office. We seldom hear much about the work of the Survey through the newspapers or radio. This is because successful exploring is not often sensational and so does not hit the headlines.

The base hut at Signy Island, South Orkney Islands, in early spring

Map of British Antarctic Territory. Not all the bases shown have been occupied continuously

The land they work in

Nine-tenths of British Antarctic Territory is covered with permanent ice. The only ice-free areas are along some coasts, on the small off-shore islands, or where the mountains are too steep for snow to accumulate. The sea is ice-covered for at least half the year and many areas, such as the east coast of the Graham Land peninsula, are mountainous. For many hundreds of miles the west coast of Graham Land rises abruptly to a plateau surface at about 6,000 feet. It is only in the far south, beyond latitude 75° South, that these mountains give way to the great featureless continental ice sheet of Antarctica (see page 1144).

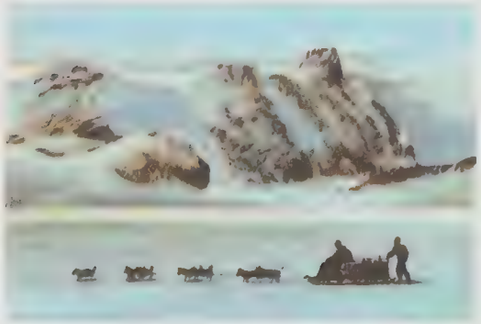
The climate is thoroughly unpleasant, for even in midsummer the temperature seldom rises much above freezing point and in winter may fall to —40°F or lower, even as far from the continental mainland as the South Orkney Islands. Although the weather is fairly settled in the far south, farther north it usually snows for part of each day. There is practically no vegetation and the only animals which frequent these shores are the seals and the birds which breed along the coastal fringe (see page 2039). There is, of course, no local population so the members of the Survey are the only inhabitants of these barren coasts and islands.

Most of the bases belonging to the Survey are situated close to the coasts. They are only accessible during the summer, when all equipment, food, and fuel must be brought there by ship. A few advance bases have been built inland and these must be supplied from the main base either by aircraft or by sledges hauled by tractors. For example, the small hut at Fossil Bluff in King George VI Sound, which is little more than a large box big enough to accommodate three men, is maintained from the larger base at Stonington Island in Marguerite Bay.

The last contact with the outside world for a year

A year at a base

The scientists who work for the Survey are usually recruited in Britain in April or May. After a few weeks of special training they join one of the Survey's ships, RRS *John Biscoe* or RRS *Shackleton*, and leave Britain in October or November. The voyage to the Antarctic via the Falkland Islands usually takes about six weeks so that they reach the northern bases about Christmas. It is usually a month or two later before the sea ice has cleared sufficiently for a ship to enter Marguerite Bay. The time when a ship is at a base is one of great activity because everything has to be unloaded and stored ashore while the ice conditions allow the ship to remain safely at anchor.

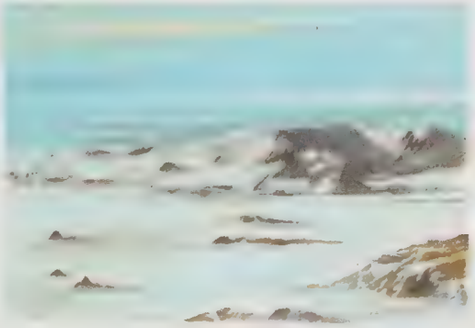


A dog team exercising on the sea ice – scientists must learn to handle them

Once the new party and their stores have been landed the ship leaves for another of the Survey's bases and this may be the last opportunity for the scientists to post letters for a year. Each base party is made up of 6 to 12 men, all of them specialists in some kind of work – meteorologists, surveyors, geologists, biologists, radio operators, and diesel mechanics. They all have to help one another with the routine running of the base. Most of the remainder of the first summer will be spent building new huts or repairing the old ones, learning how to drive a dog sledge and how to look after the huskies. At some bases there are aircraft and tracked vehicles to maintain.

The long winter night

Towards the end of March the birds and seals start to leave, the days become shorter, and the weather is even worse than usual. It is only to the south of the Antarctic Circle that the sun disappears completely at mid-winter (see page 1134), and most of the BAS bases in fact lie to the north of this. Therefore the popular idea of a long dark winter night is quite wrong. Once the sea ice is safe for travelling, people begin to work away from base, either going out for the day on skis or with a dog team, or going for a week or two on sledging journeys. This gives an opportunity to test all the camping equipment before the start of the long spring journeys.



A winter view of sea ice and mountains

Spring sledge journeys

Generally the most settled weather of the whole year occurs between July and October, and despite the fact that this is the coldest part of the year it is the time when the main journeys are made. A party may be away from base for three or four months continuously and in that time may travel many hundreds of miles. Because so much of the country is mountainous it is still better to use dog teams to pull the sledges, rather than tracked vehicles which are only satisfactory on sea ice or the inland ice sheet. The longer journeys may be supported from the air so that the party can go farther without running out of food.

Several important journeys have been made. For example in 1947 a party traversed the whole of the unknown east coast of Graham Land from Hope Bay in the north to Marguerite Bay in the south. In the same year another party continued this exploration southwards along the east coast as far as Mount Tricorn. In later years long journeys have been made through King George VI Sound, which separates Alexander Island from Graham Land. At present several parties are mapping and making a geological survey of the interior of Alexander Island. Other long journeys have recently been made

Lying up in a blizzard during a sledge journey

from Halley Bay towards the Tottan Mountains, discovered on a flight made by the Trans-Antarctic Expedition in 1957.

Routine work at base

In the meantime certain members of the party remain at the base hut to continue the routine scientific observations which form a very important part of the work of the Survey. These include making regular and detailed observations of the weather and the state of sea ice. Once the birds and seals begin to return in October the biologist too is able to continue his work.

The sea ice finally breaks up in spring or summer and a ship with more stores and men can then get through to the scientists.

The break-up of the sea ice in early summer

Normally each scientist does a tour of three years with the Survey; that is, two complete winters in the Antarctic, followed by a period in Britain when he attempts to get the results of his work in order.

Some people go back to the Antarctic two, three, or even four times, sometimes with the Survey but often with other expeditions such as the Trans-Antarctic Expedition (1955–1958) or the Royal Society Expedition which established the base at Halley Bay for the International Geophysical Year. The large number of people who are attracted back to Antarctica shows what a fascination this strange country and way of life must have.

THE PERSIAN WARS (part one)

Autumn 490 B C. The Greeks have routed the Persians at the

IN the middle of the 5th century B C the Greek historian Herodotus wrote his famous *History*, and the most inspired pages in it tell the story of how the Greeks resisted the Persian invasions a generation before. In the course of his story he tells how a Greek exile warned the Persian king Xerxes that the Spartans would resist his huge armies. 'They will never accept your terms, which would reduce Greece to slavery. . . . Although they are free men, they are not entirely free. Law is the master they own, and they fear the Law more than your subjects fear you. Whatever he commands they do, and his commandment is always the same: it forbids them to flee in battle, whatever the number of their enemies, and requires them to stand firm, and either to conquer or to die.' Xerxes laughed; and when he was marching into Greece, and a Persian spy described a small force of Spartans combing their long hair and doing gymnastic exercises in the pass of Thermopylae, he laughed again. A few days later, when many of his best troops had been killed, and the Spartans still held the pass, he laughed no more. Indeed he was to find little to amuse him in the rest of the campaign.

Greek civilisation saved

You can read about the thrilling battle at Thermopylae in our second article on the Persian Wars (see page 2504). Then you will see how one of the Greeks turned traitor and showed the Persians a path over the mountains by which they could attack the Spartans in the rear; and the pass was taken. But the heroic resistance of the Greeks to the Persians was successful in the long run. Greek civilisation, to which we owe so much, was saved. It is an exciting story, and no doubt the Greeks exaggerated the numbers of the Persians and their own dangers. But it still means much to us today that the Greeks saved themselves from slavery 2,400 years ago.

Bas-relief of King Darius, the man who led the first Persian invasion into Greece

Map of Ancient Greece showing the theatre of the Persian Wars

But the story begins before this – before King Xerxes came to the throne. For by 500 B C the Persians were masters of the greatest empire the world had known (see page 2150). Their latest conquests to the west had been Asia Minor and modern Turkey; next they began to swallow the Greek islands in the Aegean. Was there any power that could stop them?

Revolt of the Greeks

The Persian advance caused consternation in the Greek world. Those Greeks who had fallen under the Persian empire desired to be rid of it and naturally looked to Greece itself, which had not yet been swallowed up, for support. The revolt of the Asiatic Greeks against the Persians, which broke out in 499 B C, brought help from Athens and from Eretria, though none from Sparta. In 498 the rebel army, under Aristagoras the Milesian, captured and burned Sardes. This infuriated the Persians, and after the Greeks were defeated at Lade in 494, King Darius determined to invade Greece to punish the Athenians for helping the revolt; and once and for all to get rid of the menace that an independent Greece provided to his giant empire with its many Greek colonies.

In 492 Darius had been king of the Persians for 30 years, and had seen all their enemies fall victim to his armies. In this year his preparations to carry the war into Greece were complete. He began badly. He sent an army into Thracia and a fleet through the Aegean; but the fleet was severely damaged by a violent storm off Mount Athos, and the army by a Thracian tribe. Neither managed to reach the mainland of Greece, though Thracia and Macedonia came for a period under the Persian yoke.

Darius invades the mainland

Darius lost no time in preparing to push on into Greece. Two years later, in 490, a new expedition was ready. It crossed the Aegean in a fleet, Herodotus tells us, of 600 ships. Islands and cities fell before it and most of the Greek cities made no attempt to fight.

The two greatest cities in Greece were Athens and Sparta (see pages

battle of Marathon and pursue their fleeing enemies as they run to their boats. This battle was one of the decisive events of world history

2394 and 2438). Sparta was a military state, its soldiers the best in Greece; Athens was strong on sea and land, but its citizens enjoyed a much more varied life than the Spartans. Athens was coming to be the chief centre of Greek civilisation. One of the most famous of Greek playwrights, Aeschylus, fought in the Athenian contingent at Salamis (480 B C); and when Herodotus was exiled from his native city, Halicarnassus in Asia Minor, in the middle of the century, it was natural for him to go to Athens. Exiles from Athens had made contact with the Persians, and the Persian plan was to capture Athens quickly with the help of traitors in the city, so dividing the Greeks.

The day came when the Persians disembarked in Attica. Only the Athenians and the Plataeans marched to meet them, and camped on the Plain of Marathon 26 miles from Athens. The Athenians did indeed try to enlist the help of Sparta. They sent a famous runner, Pheidippides (Philippides), to Sparta to ask for help; and his run – nearly 140 miles in a night and a day – has given us the word 'marathon' for an exceptionally long run or walk. But under their law the Spartans had to wait for the full moon before they could march, and they came to Attica too late for the battle. So the Athenians fought with only the help of the little city of Plataea.

Bust of Miltiades, the great Athenian leader

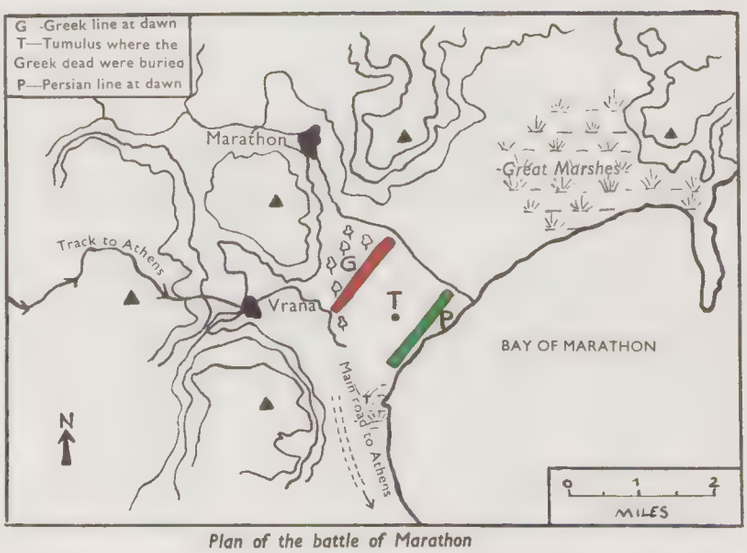
Marathon

The Athenian generals were divided as to whether it was wise to attack the much larger Persian army. Eventually they were won over by the enthusiasm of Miltiades, who was given command for the battle itself. He arranged his army with a weak centre and strong wings. The Persians broke through the centre of his army, but his two wings defeated the contingents opposite them and then turned upon the Persian centre and crushed it. The survivors of the Persian army fled to the ships and escaped.

As the Persians fled a shield flashed in the sun on one of the hills around the plain; and this was thought to be a signal from Athenian traitors suggesting to the Persians that they attack Athens while the army was still at Marathon. So the Persians hastily sailed towards Athens; but when they arrived the army was already there, and so the Persian fleet 'after resting awhile on their oars, departed and sailed away to Asia'.

YOU SHOULD NOW KNOW

1. *When did Herodotus write his* History*?*
2. *Who ran to Sparta to warn of the approaching Persians?*
3. *When was the battle of Marathon?*
4. *Who was King of Persia at the time?*
5. *Who led the Athenian army at Marathon?*



Plan of the battle of Marathon

RHINOCEROSES

TWO vehicles, a jeep and a heavy truck, are moving slowly across the *veld*. Both are driven by Africans; the truck has a crew of a dozen men, and by the driver of the jeep sits a European game warden with a strange-looking short gun across his knees. Suddenly the men in the truck give a yell and all point in one direction; there, 400 yards away and partly screened by some bushes, is the grey bulk of a rhinoceros.

'It's a cow rhino,' says the driver of the jeep. 'She's been around here for several days.' 'So much the better,' answers the game warden. 'Gently now, we've got to get really close.' At 50 yards the rhino raises its head, stands for a moment and then charges straight for the jeep. The driver goes on slowly and then, at the last moment, he swerves and the beast thunders past, a few yards away; as it passes the game warden fires his gun, but there is no loud report, only a dull '*dunk*'. These people are shooting a rhino with an air gun!

The jeep turns and gives chase. Soon the animal slows down to a walk and then stumbles and falls on its side. The truck draws up beside it; the men jump down and tie its feet securely, and it is then carefully and gently pulled up a ramp on to the truck. The 'bullet' was a hypodermic syringe filled with anaesthetic, and before the vehicles move off the beast is showing signs of life again. Another rhino will be safely housed in a zoo; if it is properly fed and treated it will very probably breed there, secure from the hunters who persecute these animals so persistently.

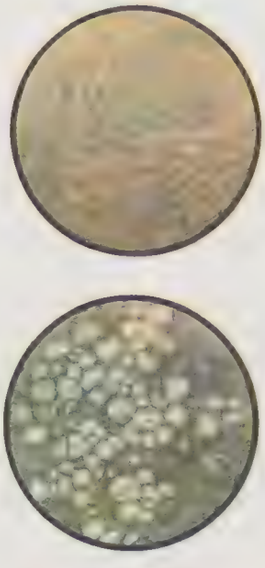
An ancient race

The five species of rhinoceros found alive today are the dwindling remnant of a group of animals once numerous and widespread. In the Ice Age, when mammoths roamed the cold plains of Europe, a cold-weather rhinoceros with a thick woolly coat roamed with them and was hunted by early Stone Age man. The greatest mammal that ever walked the earth was a kind of rhinoceros, though it had no horn. This was *Baluchitherium* (see page 1395), which lived in the Miocene period, 20 million years ago, and stood over 16 feet high at the shoulder.

Rhinoceroses belong to the Order of mammals called the Perissodactyla or odd-toed ungulates. Their nearest living relatives are the tapirs of South America and the Malayan region, and the horse, ass, and zebra belong to the same Order. They all have an odd number of functional toes; rhinoceroses and tapirs make three-toed footprints, horses one-toed.

Two white rhinoceroses in a game reserve in Africa.

White or square-lipped rhinoceros (*Diceros simus*). This is the largest species and, after the elephant, the largest existing land mammal. It may weigh as much as 4 tons and the front horn occasionally reaches 5 feet in length. The English names for the two African rhinos, 'white' and 'black', are misleading, as



Rhino's skin; African (above) and Indian (below)

They are fast disappearing

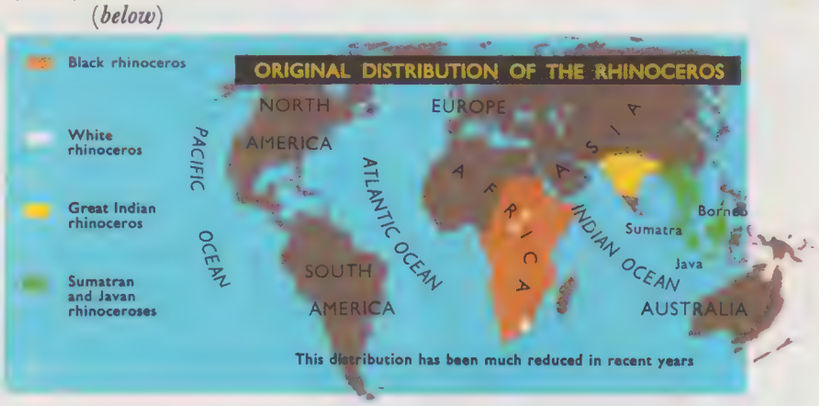
Four of the five living species of rhinoceros are rare or very rare animals, and the numbers of the only common one are rapidly being reduced. The reason for this state of affairs is both curious and sad. There is a belief in oriental countries that parts of the rhinoceros, especially the horn, can be made into very powerful medicine. As a result people will pay enormous sums for rhinoceros horn. In fact, no part of the animal's body has any particular virtue as medicine; this belief is founded wholly on superstition. But wherever rhinos live they are mercilessly hunted and it is very difficult to protect them.

Great efforts are being made to preserve rhinoceroses in game reserves, but possibly the only way to save them will be to breed them in zoos.

HORN FORMED OF COAGULATED HAIR

The African rhino's skull has no incisor or canine teeth

Rhinoceroses have one or two horns on their noses, according to the species. These horns are not attached to the bone and are formed of hair which has grown together to form an extremely hard, solid substance.



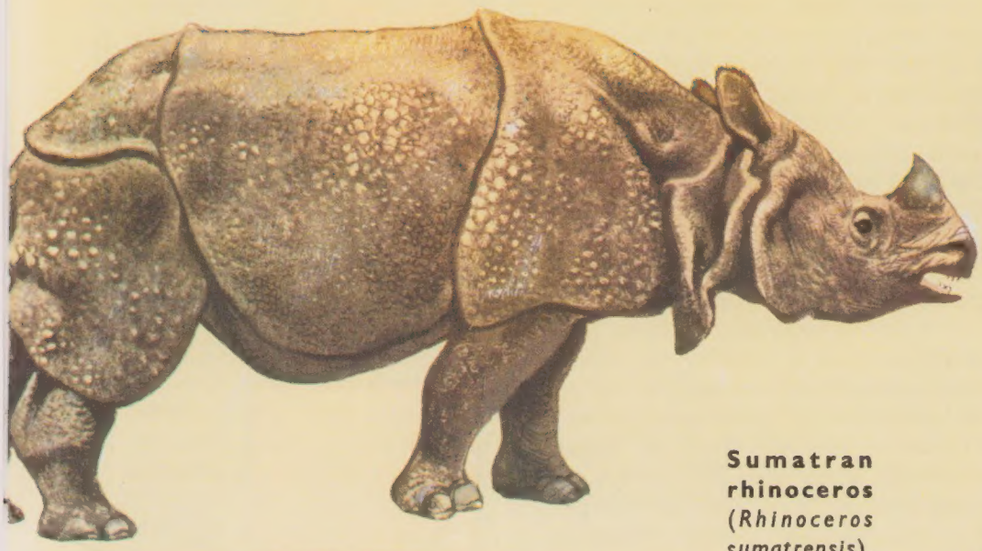
They feed on grass and are placid, mild-tempered animals

Black or hook-lipped rhinoceros (*Diceros bicornis*). Black rhinoceroses are smaller than the white, and their upper lips are pointed and are used for grasping and tearing off leaves. They are the least rare of the rhinoceroses, and there are probably about 12,000 still alive; they are distributed over most of Africa south of the Sahara.

The black rhino is a dull, bad-tempered animal, very liable to charge without any provocation, and it will readily attack a man or a train.

both are grey. The upper lip of the white rhinoceros is broad and square; possibly the term 'white' was confused with the Afrikaans word *wyt*, meaning 'wide'. White rhinos live in Uganda, the southern Sudan, and Natal, and only a few thousands of them are left. They are placid, inoffensive animals that will never attack without provocation.

ONE OR TWO HORNS



Great Indian rhinoceros (*Rhinoceros unicornis*). This species is nearly as large as the African white rhino. It has a very thick, rough skin, which hangs in a series of folds, and only one horn.

When it attacks it does not use its horn, but slashes with the sharp tusks in its lower jaw, rather as a boar does. It is found in small numbers in northern India and Nepal.

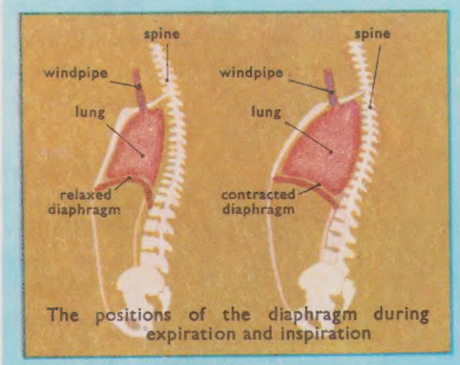
Javan rhinoceros (*Rhinoceros sondaicus*). A one-horned species, formerly widespread in south-east Asia, but now nearly extinct and confined to Java.

Sumatran rhinoceros (*Rhinoceros sumatrensis*). The smallest of the rhinos, with two horns and a hairy skin. It inhabits hilly jungle country in Malaya, Sumatra, and Borneo.

BREATHING

PERHAPS you are a fresh-air enthusiast. If so you may choose to leap from your bed and start each day by taking a dozen or more deep breaths at your open bedroom window. As you do so you breathe more deeply and more slowly than usual, for both the depth and the rate of your respiration is under your conscious control. However, during the rest of the day there is little time to think about breathing, and you probably do not give it another thought. Nevertheless respiration goes relentlessly on unnoticed. It comes under a part of the brain called the *respiratory centre*, which, quite unconsciously and automatically, regulates both the rate of breathing and the depth of each breath. It is this vital respiratory movement which provides the body with the oxygen it needs, and disposes of unwanted carbon dioxide.

During deep breathing the movements are the same as those in quiet breathing, only exaggerated. As a deep breath is drawn in, or *inspired*, the chest is felt to expand and to move upwards, and the abdomen to bulge forwards a little (see page 768). When the air is breathed out, or *expired*, the chest falls and shrinks, and the abdomen flattens. These changes in the shape and in the size of the chest and the abdomen are caused by the action of the muscles in the chest wall, the *intercostal* muscles, and by a large flat muscle, the *diaphragm*. The effect of their contractions is to increase the volume of the chest cavity and thus cause air to flow down the respiratory passages into the lungs. Then when inspiration is complete the muscles relax, the size of the chest diminishes, and the breath is expired. After a brief pause the intercostals and the diaphragm again contract, and in this way the cycle of inspiration and expiration continues throughout the whole of our lives.



The positions of the diaphragm during expiration and inspiration

THE DIAPHRAGM

The diaphragm is a sheet-like muscle which is attached all round its edges to the lower part of the chest wall. It separates the cavity of the chest from that of the abdomen. In shape it is an irregular dome, bulging upwards into the chest. When the muscle of the diaphragm contracts the dome flattens, thus increasing the capacity of the chest cavity. At the same time, however, the contents of the abdomen are pushed downwards and this is why the abdominal wall bulges a little each time a breath is taken.

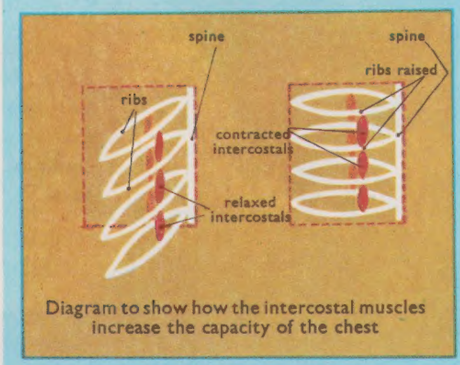


Diagram to show how the intercostal muscles increase the capacity of the chest

THE INTERCOSTAL MUSCLES

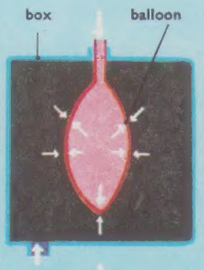
The spaces between the ribs are filled with the short fibres of the intercostal muscles. These muscles are arranged in a sloping way so that when they contract the front parts of the ribs and the breastbone are moved upwards. As a result of this movement there is an increase in the diameter of the chest cavity and a corresponding increase in its volume. The part played by the intercostal muscles is relatively greater in females than in males, which explains why women breathe in relatively more air.

THE PLEURA

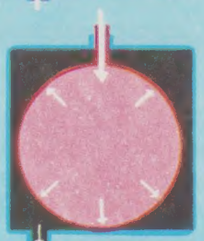
Each of the lungs is surrounded by a double-layered membrane called the *pleura* (see page 1801). The outer layer of this membrane lines the chest cavity and is firmly attached to the inside surface of the ribs and the upper surface of the diaphragm. The inner layer is stuck to the surface of the lungs. Although the two layers are not joined, they are always in close contact with each other, there being only a *potential* space between them. During respiration the layers slide upon each other so that the lungs always completely fill the whole of the chest cavity.

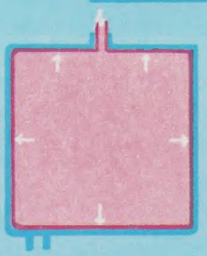
BREATHING ACTION

In order to understand how the movements of the chest and the diaphragm control the flow of air in and out of the lungs, let us think of a balloon fixed inside a box.

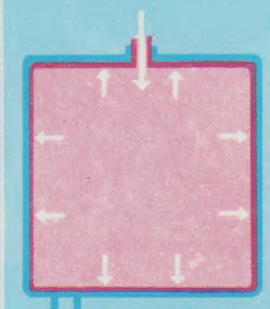


When both the balloon and the box are open to the air the balloon hangs only partly filled.


But when the air pressure in the box is reduced, air flows in and distends the balloon.


The lungs are like the balloon, except they always fill the chest completely.

When the chest expands the outer layer of the pleura is pulled outwards, reducing the pressure in the pleural space.


To equalise the pressure air passes into the lungs, which expand and fill the extra space in the chest cavity. When the chest decreases in size the pressure in the pleural space increases. As a result air is driven out of the lungs.

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Philip of Spain and Elizabeth I

Lacing became popular and the front and sleeves of both doublet and gown were loosely tied with strings or ribbons.

In the reign of Henry VIII every style was carried to extremes and had a hundred variations. The men now wore the finest feathers while the women presented a sombre contrast, in dark-coloured dresses that showed off their fine jewellery.

Queen Mary's marriage to Philip of Spain in 1554 increased Spanish influence on English fashion; doublets now ended at the waist and men wore *mock-coats* (cloaks with false sleeves) or short capes. The Spanish *farthingale* also arrived; this was a conical framework worn under the skirt. The front of the skirt had to be divided to fit over it, revealing an expanse of heavily embroidered undergown or *kirtle*.

The greatest wealth of ornamentation and confusion of style came when Elizabeth I was on the throne; nothing was casual, simple, or natural. Hair was dyed, curled, and fluffed out; faces were gaudily painted; shoulders, waists, stomachs, and hips were padded, corseted, wired, and distorted. After the introduction of starch in 1564 ruffs reached ridiculous proportions and in the 1570s the huge drum-shaped French farthingale arrived. A semi-circular version was worn by the more timid court ladies.

Mid-18th century

A new freedom

As the 17th century progressed the padding and stiffening gradually disappeared. There was a new freedom of dress coupled with soft materials, pastel colours, and delicate embroidery. The beauty of the fabrics and workmanship was enhanced by the simplicity of the designs.

Court dress, 17th century

Everything French was popular at court at this time, particularly after the arrival of the French Queen Henrietta Maria. For the first time women's arms were bare to the elbow, framed in lace ruffles that were repeated round the scooped necklines. The full skirts, unsupported by frames, were not only divided in front but also 'tucked' or looped up over the petticoat all the way round – a style made necessary by the disgusting condition of the streets.

These simple designs soon became sophisticated and over-decorated; the only exception was during the grim years of Cromwell's Puritan Protectorate when

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Regency, about 1820

dress was plain and simple in the extreme.

When the first Hanoverian king came to England the fashions that flourished under Charles II lapsed with startling suddenness into complete carelessness and frivolity of dress. Over the new oval hooped skirt (*crinoline*) was worn, or rather thrown, a loose, shapeless overgown or *contouche*, sometimes tied with ribbons down the front. A variation was the *saque-back*, an overgown cleverly stitched into folds in front to accentuate the figure. Women now tucked their hair away under a tiny cap that later became the larger mob-cap.

Men wore long jackets and waistcoats that flared out from narrow shoulders; full-bottomed wigs and flowing locks were soon replaced by neat, powdered hair-styles.

By the 1780s the shaped gown had returned, always with some sort of apron in front. The skirt was again 'tucked' but now formed a bustle at the back; frills and flounces were everywhere. Until this time little boys were always dressed exactly like their fathers; girls wore a simplified version of their mothers' clothes. But now children's clothes became very simple, almost identical to the Regency styles that were to be popular 25 years later.

The 19th and 20th centuries

In the early 19th century the French Directoire and Empire styles (both on classical lines) firmly established themselves in Regency England. The high-waisted shifts of flimsy muslin, with no padding or shaping at all, clung to the figure and must have seemed very indecent to ladies brought up in crinolines. As a compromise, a knee-length overtunic or *pelisse* was sometimes worn.

Men's double-breasted tailcoats were cut away in front to make riding more comfortable. By 1805 trousers, worn previously only by small boys and sailors, had become firmly established for men instead of breeches and hose.

The Napoleonic wars brought a military air to men's fashions, followed by padded shoulders and waisted jackets, which lasted for the next 100 years.

From 1820 to the present day women's

About 1900

About 1860

fashions have changed with an amazing speed, reflecting perhaps the increasing pace and scope of living. Shoulders widened in the 1830s while skirts ballooned. Women's jackets shrank; cloaks and shawls increased in variety. Rosebuds and white dresses appeared everywhere, symbols of Victorian innocence. In the 1860s crinolines gave way to the *bustle*, and then to the statuesque fashions of the 1890s.

The 20th century saw many changes in the lives of women. Not only were they free to vote, marry, and work as they wished, but their clothes developed a new freedom as well. Most revolutionary of all was the shortening of skirts. And when the arrival of war deprived the country of its manpower, women were finally permitted to wear trousers.

The 1920s